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9. A vibration generating device for a small wireless machine, comprising:

an eccentric load portion;

two side walls extending from said eccentric load portion, each of said two side walls having

(i) an inner surface, such that a groove having an open end and a bottom is defined between said inner surface of one of said two side walls and said inner surface of the other of said two side walls,

(ii) an outer surface,

(iii) an end surface interconnecting said inner surface and said outer surface and positioned at a level relative to the bottom of said groove, said end surface having a first end and a second end, and

(iv) a caulked portion extending into said groove from a location that is between said inner surface and said outer surface, and said caulked portion being positioned at a level that is closer to the bottom of said groove than is the level at which said end surface is positioned <u>such that defined in said end surface is a recess which opens into said groove and does not extend completely across said end surface, whereby</u> along an intersection of said end surface and said outer surface said end surface is continuos from said first end to said second end; and

a motor shaft positioned within said groove between said caulked portion of each of said two side walls and the bottom of said groove [such that said motor shaft is in its entirety between the bottom of said groove and said end surface,

wherein said caulked portions result from deforming respective portions of said two side walls from the open end of said groove toward the bottom of said groove such that said motor shaft is maintained in said groove via said caulked portions, whereby said motor shaft is integrally coupled to said eccentric load portion].

10. The vibration generating device according to claim 9, wherein [said caulked] [portion defines a recess in said end surface,] said recess [having] has a first side and a second side, with said first side being nearer to said inner surface than is said second side and with said second side being nearer to said outer surface than is said first side, and with said first side having a dimension extending in a direction from said first end of said end surface to said second end of said end surface that is greater than a dimension of said second side extending in a direction from said first end of said end surface to said second end of said end surface.

13. The vibration generating device according to claim [12] 11, wherein said motor shaft has a diameter, and wherein said inner surface is configured such that said groove includes a portion that surrounds said motor shaft for at least 180° of said motor shaft and such that the open end of said groove has a width that is from 70% to 95% of the diameter of said motor shaft.

16. The vibration generating device according to claim 15, wherein [said caulked] [portion defines a recess in said end surface,] said recess [having] has a first side and a second side, with said first side being nearer to said inner surface than is said second side and with said second side being nearer to said outer surface than is said first side, and with said first side having a dimension extending in a direction from said first end of said end surface to said second end of said end surface that is greater than a dimension of said second side extending in a direction from said first end of said end surface to said second end of said end surface.

18. The vibration generating device according to claim 15, wherein said end surface has a width dimension W extending from said inner surface to said outer surface, and said [caulked portion defines a] recess [in said end surface that] extends from said inner surface toward said outer surface a distance within a range of from 0.25W to 0.90W.

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(B) is positioned such that defined in the end surface is a recess 14f which opens into the groove and does not extend completely across the end surface, whereby along an intersection of the end surface and the outer surface the end surface is continuous from the first end to the second end as shown by the peripheral side portion 14b.

[0034] Then, in a tip portion end surface 14a of the side wall 14, at a central portion, but not at both end portions in the direction of the axial line O, a portion 14c, except at an outer peripheral side portion 14b of the side wall 14 and at the side 12 of the groove 13, is caulked by a rectangular parallelepiped caulking punch 15 from an opening side of the groove 13 to a bottom side thereof, so that the above vibrator 10 is integrally coupled to the rotating shaft 12. Here, in a width dimension W of the tip portion end surface 14a from the side of the groove portion 13 to an outer peripheral side, the portion 14c to be caulked at the side of the groove portion 13 is set in the range of 0.25 W to 0.9 W from the edge portion at the side of the groove 13.

(A)

[0035] The rotating shaft 12 can be made of stainless steel, for example, SUS 420 or the like. The vibrator 10 is preferably molded by using an ultra heavy alloy material of a specific gravity of about 17 to 19 g/cm^3, for example, W-Ni system, W-Ni-Fe system, W-Ni-Cu system, W-Mo-Ni-Fe system, or the like, and by performing a powder metallurgical technique. Specifically, a mixture powder of a composition made of: W powder of 89 to 98 weight %, and Ni powder of 1.0 to 11 weight %, or a mixture powder of a composition containing the W powder and Ni powder in the above range of weight %, and one or more kinds of Cu of 0.1 to 6 weight %, Fe powder of 0.1 to 6 weight %, Mo powder of 0.1 to 6 weight %, and Co powder of 0.1 to 5 weight % is or are compacted into a fan plate shape by applying a pressure of 1 ton/cm^2 to 4 ton/cm^2. This compact is liquid phase sintered in a hydrogen gas stream having a dew point of 0°C to -6°C or in an ammonia decomposition gas, and thereafter, the compact is further heated in the temperature range of 700°C to 1430°C ± 30°C in a vacuum, neutral or reducing atmosphere. Then, a heat treatment to rapidly cool the compact to at least 300°C at a cooling rate of 40°C/min or more is performed.

(A) In other words, as shown in Fig. 3, each side wall 14 includes an inner surface 14d that the groove 13 is defined between, an outer surface 14e, the end surface 14a, which intersects the inner surface and the outer surface, with the end surface having a first end 14f and a second end 14g; and the caulked portion 14c which extends into the groove from a location that is between the inner surface and the outer surface, with the caulked portion being positioned at a level that is closer to the bottom of the groove than is the level at which the end surface (B)

[0051] FIGS. 8 and 9 show a vibrator 40 according to a fourth embodiment of the invention and its modified example, respectively. The vibrator 40 has substantially the same shape as that shown in the first embodiment, and the entirety of a fan-shaped portion that is eccentric from its axial line is an eccentric load portion 41. In the vibrator 40, a semicircular groove portion 43, in which a rotating shaft 42 of a motor is fit and which has a bottom portion with a size substantially equal to a diameter of the rotating shaft 42, is formed at the central portion of an outer peripheral arc which depicts the fan shape of the eccentric load portion 41. Side walls 44 extending from the eccentric load portion 41 in parallel with each other, and defining both side edge portions of the groove portion 43, are integrally formed at both side edge portions of the groove portion 43.

[0052] Then, in a tip portion end surface 44a of the side wall 44, and at the central portion thereof, but not at both end portions thereof, in an axial line direction, a portion 44c of the side wall 44, which does not include an outer peripheral side portion 44b of the side wall 44, at the side of the groove 43 is caulked by a cylindrical caulking punch 45 from an opening side of the groove portion 43 to a bottom side thereof, so that the above vibrator 40 is coupled to the rotating shaft 42. Here, as a result of caulking by the cylindrical caulking punch 45, concave caulked portions 44c formed at the tip portion end surfaces 44a, respectively, become substantially semi-circular, and are formed so that a length dimension L in the axial line direction at the side of the groove portion 43 becomes larger than a length dimension at an outer peripheral side of the concave caulked portions 44c. (i.e. a first side of a recess 44d defined by caulked portion 44c) (i.e. a second side of the recess 44d)

[0053] In a vibrator 40 shown in FIG. 9, at the central portion of a tip portion end surface 44a, a portion 44c' of a side wall 44, which does not include an outer